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THE

NEW ENGLAND

Journal of Dentistry.

VOL II. JANUARY, 1883. No. 1.

ORIGINAL COMMUNICATIONS.

THE CHEMICAL COMPOSITION OF DECAYED DENTINE.

BY CHARLES MAYR, A. M., SPRINGFIELD, MASS.

Some four years ago, though an outsider, I commenced to study more carefully the chemical facts connected with dentistry, and was first of all struck by the absence of sure data on which to base conclusions. The majority of the dental gentlemen I came in contact with had a pretty good idea of the histology and microscopy of the teeth, and an excellent one about the practical points in mechanical dentistry. But in spite of the fact that quite a number of eminent practitioners are at the same time excellent chemists, I missed exact statements as to certain points without which statements theoretical dentistry always would be but imperfect. I could explain to myself this apparent lack in no other way than by the fact that the most educated practitioners are those who are most busy, and find the least time for theoretical work, while those who have time do not have the necessary apparatus or training. Especially painful became this lack of reliable data when the question of decay came up and discussing it, we were all in complete ignorance. I heard the best of them talk about solution of lime-salts, etc., but being relatively familiar with the action of acids on lime-salts, from the very first moment I began to study carefully, it seemed to me improbable that such a com-

plicated process like a decay, should be the action of a simple acid, the result of which I knew relatively well. So, from the very first, I was forced to combat the crude acid theory, which regarded a tooth like a block of marble, and felt somewhat inclined to the consideration of decay as a purely pathological process, comparable to chronic ulcers in other parts of our body. While this theory, as chiefly advocated by that eminent school of dentists at New York, excellently accounts for many symptoms of decay, and therefore claims a great deal of our full consideration, the chemical process of decay I could not imagine as being produced by the simple pathological changes in protoplasma, connective tissue, and lime-salts of the tooth as the consequence of the action of an acid. But I felt the nebulosity in which we moved when attempting to explain decay, from the simple fact that we were not acquainted with any exact results of analyses and experiments concerning the decayed mass as compared with sound dentine. Thus stimulated, I tried to fill out the gap I found—if successful, the reader himself may judge.

Let us never confound two things: the *structure* of a tooth and the *chemical nature* of a tooth. The first will mainly be governed by physical laws, while the second is governed by chemical laws, or at least less grossly mechanical laws. If we take the same quantity of a phosphate of lime, of carbonate of lime, of fluoride of lime, of magnesia, of connective tissue, of protoplasma and water, and rub them together in a mortar, and knead a tooth of them, we will have exactly the same substance as in a tooth, but while this tooth may behave chemically very similar to a tooth in the mouth, mechanically and physically there is no resemblance between the two. It seems to the writer one of the mistakes of some students in this line that they overlooked the importance of the connection of structure and chemical nature together. We cannot lose sight of either for a moment, but we had better discuss these questions after we have given results as a basis.

During the months of August and September, 1882, I made a series of very careful experiments in the line of analyzing decayed dentine. Probably very few are aware of the great labor involved in such work; not only is the quantity of material that can be obtained very small, it also has to be selected with great discrimination, and the results have to be carefully sifted. Many results had to be thrown out entirely, because evident errors had crept in from the presence of old fillings in a decayed mass (as proved by the presence of zinc in the residue), or from slight inaccuracies of weighing, etc.

But, even throwing out every experiment which might be considered doubtful, the remaining ones are so that they do not admit of any fair doubt.

Some things about the necessary requirements for such experiments. What to the histologist the microscope, that is to a chemist a fine and delicate balance, and as the value of a microscopist depends in a large degree upon the power of his instrument, so the value of a chemist in a great measure depends on his chemical balance. The balance in our laboratory easily and unmistakably could be adjusted to $\frac{1}{20}$ milligram ($\frac{1}{1200}$ of a grain), and during these experiments we had to work with this nice adjustment, necessitating very slow and tedious work. One weighing sometimes took one and two hours and more. As the quantity of decay of uniform structure—not of a composite mass, very often was less than $\frac{1}{30}$ of a grain, an error of $\frac{1}{10}$ of a milligram considerably influenced the result. The losses were always determined without removing the first weights from the weight pan, but only removing the difference, so that no objection could be raised against accidental errors, e. g., if a decayed mass on the platinum lid of a crucible, together with the lid of 2801.05 milligrams weighed 2802.15 milligrams, and it was found after ignition that the residue still weighed 2801.70 milligrams, and the lid after the removal of the little lime residue weighed 2801.05 milligrams as before, there was no mistake possible, the result was simply:

Weight of lid + decayed mass,	2802.15	
" " alone,	2801.05	
Weight of decayed mass to be analyzed,		1.10 mgrs.
Weight, after ignition, of lime-salts and lid,	2801.70	
" of lid,	2801.05	
" of lime-salts,		.65 mgrs.

Hence 1.10 milligrams decayed mass gave .65 milligrams lime-salts, or 59 per cent., etc. If we wish to determine how much lime-salts or organic substance have been lost, we must determine the amount of water in the decayed masses, not only in sound dentine. This was not possible in all cases, but I tried to determine it in a few. I made the following investigations:

First. Does the decayed mass contain any compounds of lime-salts and organic acids? (The question of free organic acids being left out because it could not be entertained for one moment.)

Second. How much water is in decayed masses compared with a healthy tooth?

Third. How much lime-salts and organic matter are left?

To answer the first question, I scraped out the decay of many teeth, and treated them with pure water. There is no ordinary organic acid—except oxalic acid—whose lime-salt is not somewhat soluble in water; acetate and lactate of lime are even easily soluble. I tested in many ways in this direction, and with but very few exceptions the results were negative; there was in the decayed mass no acetate or lactate. I will not forget to mention that generally I excluded the outermost layer as not being a fair test for what we want to investigate. What is of interest is not the outside mass of decay, and we will learn but little from it as to the starting of decay, but the inner layers more remote from the direct daily contact with food. The experiments of this kind all pointed uniformly to the absence of organic acid compounds in the inner layer. (If a decayed mass was say three millimeters deep, I did not take for experiment in this case the first two millimeters.) About half a dozen of these experiments were made very carefully, thinking that a relatively small number carefully executed is worth more than a thousand, carelessly done. Great truths in chemistry have not been ascertained by the quantity of work, but by the quality, and, to compare small things with large ones, when Liebig found the organic formulæ by his experiments in the determination of the composition of organic substances, one analysis was generally worth far more than the hundreds of experiments of earlier investigators.

Secondly. How much water is in a decayed mass? To determine this, the decayed masses were dried for about six hours, at 105° C. (221° F.), and their weight ascertained at intervals; after this time the weight generally remained constant, and did not diminish any more.

Thirdly. The percentage of organic and inorganic substance in decay was ascertained by igniting the small dried mass on a platinum lid, first in common air, and then in a gentle stream of oxygen until it was perfectly white. To convert back any caustic lime that might have been formed, the white mass was evaporated repeatedly with carbonate of ammonia, until the weight remained constant. By this method, the lime-salts were obtained in the same form in which they were in the tooth as phosphates and carbonates. It was then carefull weighed and the results calculated.

Results to No. 1. No acids or soluble lime-salts are in the innermost decayed mass; hence no acetic, tartaric or lactic acid had dis-

solved much of the lime-salts, because the acetates, lactates, etc., would not have been washed out completely from the decayed mass, but a small amount would still remain which, being soluble, would be easily shown by oxalate of ammonia acid.

Results to Nos. 2 and 3. One large decay was sliced up into several parts, and the slices analyzed according to the above plan.

First slice—Outermost, very gelatinous soft layer.

Water, 58 per cent.; organic, 26 per cent.; lime-salts, 16 per ct.

Or, omitting the water, organic, 61 per cent.; inorganic, 39 per ct.

Second slice—Middle, water not determined because no longer reliable. (The specimen had become a little dry.)

Organic, 55.8 per cent.

Inorganic lime-salts, 44.2 per cent.

Third slice—Innermost, white friable mass just close to the healthy dentine, scraped out with a soft iron wire, and very crumbling.

Organic, 32.1 per cent.

Lime-salts, 67.9 "

This decay which was analyzed in these slices shows therefore from the outside a uniform approaching to the normal composition of the tooth. It shows that the lime-salts are removed, but not in any way which the acid theory demands. The removal is secondary, and the simple consequence of the action of the liquids of the mouth, which act more on the outermost layers, and gradually less and less, until at the border line no action of the acids is perceptible, while the structure is completely broken down. While therefore the secondary process of disintegration of the decayed mass is plainly referable to the action of the liquids of the mouth, the action at the innermost layers is not in accordance with what we know about the action of acids. While the chemical composition of the innermost layer is almost (and as was seen in some cases completely) identical with that of healthy teeth, the structure is totally different. The tooth is disorganized, the soft friable white decay is no longer organized, though chemically only slightly differing from the tooth substance. Several other experiments were made, but none as consistent as the one cited above. One black decay showed in the total 49 per cent. lime-salts, and the innermost layer 72 per cent.; another sample of decay as a whole gave 56 per cent. lime-salts. The experiments are not yet concluded, but are still going on. The lowest amount of lime-salts was met with in the case cited, 39 per cent. As the experiments are not of equal nature in

exactness, it would not be fair to make a general average of them, but the results given are sufficient to establish the facts already mentioned formerly. In one case only did I attempt to determine the proportion of phosphates in decay, and to compare them with the healthy tooth, but the quantity of substance experimented on proved too small, and the result was unreliable. The carbonates are of course greatly diminished in the outer portion of decay, but the innermost white layer still contains them, similar to normal dentine. I shall endeavor in my future experiments to keep this point in consideration. I am afraid the patience of my readers has been wearied too long, and I shall not give them my opinion as to the cause of decay, because on these points others can do it better and more impartially.

ANNUAL ADDRESS,

Read before the Connecticut Valley Dental Society, October 26, 1882.

BY C. FONES, D. D. S., BRIDGEPORT, CONN.

In accordance with a custom of this Society, it is the duty of the retiring President to prepare and read an address, and in complying with this custom, I do not intend to occupy much of your valuable time. The honor conferred upon me is appreciated. This Society is noted for harmony, good feeling and its earnest desire for the truth. Ever since my connection with this organization, I have noticed that the subjects which received the most attention in the discussions were receiving attention from the best men in the profession all over this country, and I have no doubt that each one of us have returned to our several places of business, renewed in mind and body, determined to make closer observations and, if possible, do better work.

In the past, this Society has had to depend upon the executive committee for papers and other material for its meetings, and it was difficult to get papers on the various subjects that would be of interest to the members and call out a lively discussion. Last year the Society divided itself into five sections. Each section has a chairman, whose duty it is to make a report at each of our meetings.

Last June we held our first meeting, at Amherst, under the new order of things, and, despite some little failure on the part of some of the machinery to do its full part of the work, we had a very interesting meeting.

The chairmen of four of the sections had reports, which furnished first-class material for discussion during the session. The indications

are that the plan will be conducive to the advancement of the Society. . . . . .

We have all heard a great deal about manipulation, the best method, the different materials, appliances, etc. These are all right, and if we would succeed they must be looked after closely; but they should not receive our exclusive attention. Up to within a few years, very little has been said in our societies about the general system, anatomy, physiology or histology; but now (thanks to a few noble men) we understand that a tooth is a live organ, permeated by the reticulum of Heitzmann, or a net of living matter. This being the case, does it not follow that the varied conditions which affect the general system will affect the teeth? Just how nutrition is carried on in a tooth, I have never been able to ascertain; but that there is a circulation of nutrient material in a tooth I have not the least doubt. I have for years noticed the effect of the general health on the teeth, and in nearly every case where there has been a long and severe strain on the nervous system, rapid decay of the teeth is sure to follow. Especially is this the case in young patients. The general health may be fair, but the nerve centers are weakened by overtaxing their capacity to such an extent as to seriously interfere with nutrition.

It may be that the law of heredity has much to do with this condition, so that the teeth may or may not be well formed. The patient having inherited a nervous system, incapable of standing a severe strain, is so weakened as to be unable to properly perform the function of nutrition in the teeth, thereby leaving them an easy prey to the forces outside of the teeth.

I would liken the tooth to a fort which is well built, supplied and mounted, and successfully resists every attack of the outside forces, until the men are stricken with some contagious disease, the supplies are exhausted or cut off, so that the forces within become weak and emaciated; then the forces outside attack the fort in its weakest place, and finding little or no resistance, are able to break it down.

I will read an extract from a paper which I read before this Society some four or five years ago, and the observations that I have made since that time have only strengthened the convictions I had then:

"One of our greatest medical philosophers (Prof. Jackson of Phila.) deplores the marked tendency of the physical organization of women on this continent to degenerate. Is it not reasonable to suppose that this weakening of the physical forces of the mothers of this country (thereby reducing the organic forces) has more to do with

the congenital anomalies, so often seen in the teeth, than the lack of a sufficient quantity of the lime element in the blood? Are not the fissures, pigment spots, and other abortive conditions we see in these dentures, caused by a lack of nervous energy to properly sustain the organic forces in their effort to make a perfect denture?

I am led to believe that the cause of these defective teeth is a weakening or letting down of the vital forces, thereby preventing the proper assimilation and organization of the inorganic substances." This condition may be brought about in many ways, some of which I will mention.

In cases where young persons are stimulated to great effort in their studies by contesting for a prize, the post of honor, cramming for an examination, or loaded down with too many studies. They may be over-worked physically, too vigorous exercise, excess of all kinds, boys who work hard all day, and drink, smoke, and stay out late nights; those who are taken from out-door pursuits and shut up in shops and stores from twelve to fifteen hours per day; young misses who at the age of puberty have responsibilities doubled—these and many other things that might be mentioned, in my opinion, debilitate the nervous energies to such an extent that nutrition is impaired. Each one who passes through this ordeal will receive the imprint according to the power of resistance that there is in the constitution of the person, more or less. Consequently the effect of such nervous strain would not be the same on the teeth of every person, but the expression of the injury upon the teeth would be in accordance with the power of resistance in the individual.

This, it seems to me, accounts for the fact that a person's teeth will decay with great rapidity at one time of life, while at another they will be strong and healthy—the latter condition depending upon the recuperation of the nervous energies and a consequent assimilation of the nutritive element by the teeth.

If the power of resistance is weak, decayed teeth should be filled with some low conductor until the nervous system has become more vigorous and the teeth are healthy and harder. I am not sure that this hardening is the result of a greater assimilation of the lime element in the teeth. It seems to me to be more the result of the return to health of the basis-substance. It has occurred to me that if nutrition were interrupted in a tooth, the basis substance might become emaciated the same as in case of a similar substance in any other part of the body. I have seen cases where the teeth were

badly decayed, and in the course of a year or two the progress of decay was arrested, the cavity seeming to be lined with a brown cartilaginous substance which seemed to be quite free from lime; and in every case when this condition appeared, the person was enjoying unusual good health.

Now the dentist of to-day should be one who is able to "*take in*" all of these conditions, and diagnose each case correctly. The office of the dentist is not simply to fill teeth, not a mere manipulator of materials, but to care for the teeth; and to properly perform this duty, he must be a close observer and have good judgment. There are certain pathological conditions of the teeth which must be understood before they can be treated and filled intelligently. Disease has an expression as well as health, and one must be able to recognize the kind and extent of the disease in order to treat it successfully.

To say that all teeth should be filled with any one material exclusively would be like the physician who would treat all of the diseases to which the human system is heir, with one kind of medicine; and this indicates a want of diagnostic ability and looks as though he were riding a hobby. Good judgment, with a conscientious desire to do the very best that can be done, I consider one of the most desirable acquisitions the dentist can possess. While I place a high estimate upon the ability to make fine operations on the teeth, I cannot but feel that great injury has often been inflicted, both upon the system and the teeth of patients, by a lack of judgment. One should have a thorough understanding of all the laws that govern the system, should be a close observer, and keep a true record of each case, so that a comparison can be made at any time and the difference noted. When this is faithfully done, it is one of the best educators for the dentist and lays a broad foundation for good judgment.

CRITICISING A CRITIC.

BY DR. CHAS. R. E. KOCH, CHICAGO, ILL.

In reading Dr. Davenport's article on the "Bioplasson Theory and its Critics," in the December number of the New England Journal, my attention was particularly fastened to a matter really foreign to the question in controversy, but to which all of page 389 is dedicated. The ardor with which Dr. Davenport defends not only the theories and discoveries, but also the character of Dr. Heitzmann, would have been, it seems, sufficient advocacy of them without recourse to an

attempt to cast ridicule and contempt upon Dr. Curtis—who is, later on in the article, admitted to be an "earnest searcher" after the truth—as such an attempt is illy calculated to advance the progress of science. I have not the honor of a personal acquaintance with either Dr. Heitzmann, Dr. Davenport, or Dr. Curtis, and (perhaps I ought not to admit it) I am not competent to take up sides on the main question at issue; but I desire to submit that combating an antagonist with the shafts of ridicule, while it may afford amusement to the vulgar crowd in the arena, is sophistry of the very poorest kind, and can never bewilder or obscure the minds of men capable of discerning and distinguishing the truth, who are really the ones to sit in judgment. When Dr. Davenport calls attention to the fact that Dr. Curtis resides in Chicago, and to certain "phrenological testimony" (?) with reference to people who reside in this backwoods-corner-of-the-world, he evidently counts on the applause of his audience to be produced by this *hit*, as a score for his side of the question. His allusion to the "freshness" of the Western breezes is of course a *clincher*. The testimony of Dr. Curtis stands incontestably impeached. Does not he reside in Chicago? and is not this proof positive of his incredibility? If this is not sufficient to carry conviction, here is the additional fact that he lives under the influence of the "Western breezes," and that settles it beyond a doubt! He must be wrong in antagonizing Dr. Heitzmann; and Dr. Heitzmann and Dr. Davenport must hence be the true prophets. If our Eastern brethren, while endeavoring to decipher the secrets of the structure of the blood corpuscles, are aided in their groping by the illumination such *funny* allusions afford, I do not know as we of the West should object, although it would seem that scientific gentlemen, in criticising each other, should not use the weapons of vulgar plebeians, but treat each other in a spirit of fairness, gentlemanly and scientifically. Nearly a quarter of a century's search for better light, spent under these disadvantageous "fresh" Western breezes, has failed to teach me that ridicule or vituperation has ever carried conviction to inquiring minds. Truth is mighty, and it will prevail, irrespective of who utters it or where it is uttered. I plead for the abandonment of this method of personal attack in scientific disputation. Let the exponents of different views conquer or convince each other by such weapons as logical deductions and demonstrable facts will abundantly furnish. Such a course will elevate our professional periodical literature, and make our profession more respectable in the eyes of the pursuers of co-related sciences, and hence more influential; and it certainly is more in consonance with the spirit of civilization and christianity.

SELECTIONS.

BACTERIA THE CAUSE OF CARIES.

BY F. Y. CLARK, M. D., D. D. S., N. Y. CITY.

[Read before the American Dental Convention, August, 1882.]

There is much confusion and contradiction as to the cause of dental caries. It has ever been taught in our schools, books, and until very recently by nearly every practitioner of dentistry, to be of acid origin; but the facts gained from analysis and microscopical investigation, to say nothing of overwhelming circumstantial evidence, do not warrant this teaching or belief. Over fifteen years ago we asked, in an essay before the Southern States Dental Association, What is carious dentine? How does it differ from sound tooth structure? Is it the same when detached from as when connected with sound tooth structure? Will it, when taken from its bed and placed under a filling, act on the living the same as when allowed to remain partially connected with living structure? Why are we so particular in the removal of every mite before filling? You say because, if any is allowed to remain, in the course of time it will infect sound dentine, and necessitate refilling. Would a layer of sound dentine, or any less objectionable substance, do this? You answer no. What contagious agent, then, is there in this mite of decay, to produce this? How does the same agent produce all the different shades of decay—the black, the white, the yellow, and so on? We are told acetic fermentation and acids combining with the lime of the teeth form new agents; but what those agents are, or how they act on sound structure, we are not intelligently informed.

Our fermentations, as far as we have any understanding, are alcoholic, acetic, butric or lactic, ammoniacal and putrefactive. Fermentation is the converting of organic or inorganic matter into something else. There is no fermentation without an organism. It is through air germs that first ferment is introduced, and the organisms inaugurated by these first germs inaugurate a second, and so on, to putrefaction. It is through this law of succession of organic life that all vegetation is produced. Without it earth would be a rocky waste, with no vegetation or means of sustaining animal life. It is through air germs that the first ferment of which we have any knowledge is brought about, and to the organisms thus introduced investigation as

to the laws governing higher life must begin. Exclude air from any organic matter, and it will remain unacted on and unchanged indefinitely. This is seen in every day life, for there is no animal or vegetable matter about us that is not undergoing change through this law. Whenever any production of the vegetable kingdom, from want of suitable sustenance, or the conditions necessary to a healthy development, becomes wanting or deficient, it is quickly attacked by fungi, or organisms which increase in many instances so rapidly as to destroy adjacent healthy growths. This is sometimes the source of great loss and annoyance to agriculturists, as frequently whole fields are destroyed. Now the same thing occurs in the animal kingdom when there is a want of bioplasm necessary for the building up of a member of any organism. In this bioplasm is cell matter that constitutes enamel, dentine, vein, artery, and every tissue of life, and when wanting or interrupted, no matter how caused, ferment through air germs follows, and thus are inaugurated and brought to view by the microscope the smallest living organisms called bacteria. When through the microscope we see for the first time these myriads of living, moving organisms, apparently endowed with some kind of intelligence and movement power, which enables them to swim about, turn, twist, go backward and forward, not more than $\frac{1}{3000}$ of an inch in diameter, all occupying a space not larger than the point of a needle, and are told they are nothing but plants intimately related to larger ones familiar to common vision, no wonder the mind is held in doubt, and is half inclined to disbelieve one of its own senses. But farther examination opens up a new world of investigation. We study a few works, spend a few months with the microscope, and think with Darwin and many others that evolution is a fact; that some one of these infinitesimal specks is certainly within the reach of man's production; but when we get farther on in the paths of Pasteur, Huxley, Tyndall, Cohn and Beal, and become somewhat familiar with some of their experiments, we are obliged to own that the misty veil of first life is still unrent. If air germs, as some say, come through dust from some other planet, we may ask, how come they in this dust. So, with present powers of research, we must own, as Beal puts it, there is a beyond and beyond, which man cannot reach. Through these smallest of living things decay becomes, as the saying is, but another form of life. When all of man that is earthy ceases, countless lives are inaugurated, which in turn, through fermentation, give life to successors, and so on up the organic ladder until man is again living through the agency that

brought about his putrefaction, and thus life is a circle. At one time it was a mooted question to what kingdom bacteria belonged. Many investigators classed them with infusoria, and other low organisms of animal life, but now they are generally admitted to be plants. They differ in nearly all respects from infusoria. "They have," says Cohn, "no morphological distinction of ends, no flagellata, or movement organs, and live like the amœba by absorption—by extracting what is necessary for the propagation of their species from the substance in which they are found, organic or inorganic. They are of almost every conceivable shape—round, oval, twisted, straight, oblong, screw-shape, cylindrical, and many others. They live with or without air, and are found in all animal and vegetable matters undergoing fermentation. Sometimes they are very active, and this is lasting when seen in a jelly-like mass; and again, without apparent cause, they become motionless. Sweets and fermentation increase their activity." Through the protection of a cell membrane they are enabled to resist great extremes of heat and cold, some species much more than others. We have frequently seen spirellum volutans—the largest of all bacteria—converted into ice, and become quite lively when thawed out. They are propagated by cell division, or by the formation of new joints, and subsequent separation at these joints. In favorable and unmolested localities, when conditions are suitable, their increase is almost beyond conception. One or two will increase to millions within an hour. It is by budding, their species become mixed; as on an apple tree, by budding or grafting, we have several varieties of apples—sweet, tart, sour—all different in taste, shape and shade; although the wood and bark of tree and limb is the same, the fruit is different. Thus a contagious germ can spring from a harmless parent cell, just as the poison ivy can be budded on the harmless woodbine, or the poison bitter almond on the nutritious sweet. So, also, in the lowest order of plant life, owing to causes as yet not thoroughly understood, contagious germs can spring from harmless parent cells. All tissues, veins, arteries, bones, teeth, and every special part of the body, have particular special and individual cells, all acting in harmony, constructing, building up, repairing, throwing off and removing defective and useless parts. If a cell necessary for the perfect development of a tooth is destroyed, or in any way disturbed, the tooth on erupting will invariably show the disturbance by defective enamel pits, fissures or other marks. Owing to this, we frequently see whole sets, on erupting, defective. Thus we can readily understand how any organ can be-

come defective, diseased, or missing, if these bioplastic cells are in any way interrupted. It is owing to due respect to this law that certain teeth are sometimes wanting and found in remote parts. As stated, the chemical theory of decay is, that acids generated in the mouth act on tooth structure so as to cause its decay. But with the death of Liebig, and the advancement of microscopy, this chemical school, with its nascent and atomic theories, is fast passing away, and it would now be a bold scientist who should dare to deny the crucical evidence of Pasteur "that fermentation is a change of chemical composition in organic compounds brought about by a certain class of plants which, deprived of drawing the essential element of their composition from the air, *propagate themselves in the very substance of organic matters of all kinds by the breaking up of these matters and appropriating such elements as are necessary to their own growth.* Organic matter cannot of itself bring about inorganic matter, no more than inorganic can bring about organic. This in microscopy is an accepted fact, as sterilized fluids will remain so for ages if kept free of external matter, but when exposed to air, if pabulum be added, ferment follows ferment until that of putrefication sets in, and with putrefication comes bacteria termo, an organism ever present where and when putrefaction is going on. Although bacteria termo is seen with other species, it is accepted as the true organism of putrefaction, and no putrefaction can take place without the assistance of this germ. Bacteria termo, which has somewhat to do with our inquiry, has been generally plated and noticed, but until recently its true ferment has been little understood. "If a piece of meat is placed in a glass of water after other ferments have passed and putrefication set in, a cloud will be seen surrounding the meat, and will increase and continue active as long as there is anything to putrefy—this cloud is bacteria termo. Towards the last the cloudy sediment changes color and becomes very offensive, so much so that it is painful to examine." As before stated, when the teeth are imperfectly formed, full of pits and uneven surfaces, owing to derangement of form cells—they are more easily acted on by external agents. These pits, fissures and roughened surfaces are, in many cases, inaccessible to the brush, and consequently become little laboratories for fermentation. If a mite of animal or vegetable food is left for a few days in or around the teeth, one ferment follows another, with organism after organism, until the tearing down process of putrefication or bacteria termo is in full force. One grain of vegetable or animal matter, with a few drops of

saliva placed in a glass, and kept at the normal temperature of the mouth, will generate within a few days millions of bacteria. The same thing goes on in the mouth whenever or wherever these organisms find pabulum and unmolested localities. This is a universally accepted fact with the belief of the majority, that the cause of decay is owing to acids in the saliva. After alcoholic fermentation, it is true we have acetic; but the acid of this ferment is so weak in the fluids of the mouth that it can scarcely be detected, and in very many mouths where the teeth are under rapid decay it or any other acid is not found at all. A tooth may be cut half away, and if smoothly polished it will never decay. If caries was the result of acetic acid in the saliva, would this be the case? Mycoderma aceti, the supposed ferment of vinegar, is not perfectly understood. Particles of food in pits and fissures of the teeth, where mycoderma aceti is found, has a slight yellow tint; following other organisms, such as the vibrio regula and spirochœte plicatilis, are seen; but so far as can be seen there is no perceptible action on the tooth structure until bacteria termo is present. As we said in a previous paper, it is impossible to account for or explain all the shades of carious dentine on the acid theory, for acids cannot by any law known to chemistry produce them. But on the other hand, by the pigment in the protoplasm of bacteria, all the shades seen can be produced. We don't wish to advocate the chewing of tobacco, for in the mouth it is a dirty weed, but every dentist of any experience and ordinary observation knows it has a tendency to stop decay, which no doubt is owing to the antiseptic agency of nicotine. The crown of a tooth, as you all know, is protected by a covering of enamel, which is very dense; under this covering there is what is known as dentine, which is more like bone full of tube cells, with mouths opening into the enamel. These cells, called canaliculi, are filled with nerve bioplasm, and, by measurement, are large enough for the easy entrance of many species of bacteria. Thus, from what we have said, those familiar with the laws of fermentation can begin to understand how this bioplasm—the life of the tooth—may be absorbed or converted into pabulum for destructive organisms. For, as already stated, when and wherever the enamel, through imperfect development or other cause, is thin, as under the pits or abraded surfaces, the mouths or tubes of the dentine, through fermentation, are easily entered by bacteria, which, as Pasteur and others assert, live at the expense of the organism in which they are found, by absorbing and appropriating the life matter for their own substance and the

propagation of their species. We will now attempt to show a few of the organisms found in the saliva of the mouth and carious dentine. The microscope before you has a binocular and a one-sixteenth objective. Examine first on this slide No. 1 a drop taken from the sub-lingual duct of a gentleman present in whose mouth are several decayed teeth; you will find in this saliva no organism, at least none that the power used will bring to view. Now examine this slide No. 2, on which is the fraction of another drop from the same mouth, taken with a little mucus from the pit of a second superior molar. In this you see spherical organisms, which we will not attempt at present to name or class. They are of the micrococcus species, and are generally found in first ferments. On this slide, No. 3, we have a little saliva taken from my own mouth, which has been kept at normal temperature for nearly two days, and which is now in a state of fermentation. In this, you see, the organisms are larger, quite numerous, and active. They are slightly different in shape, but no doubt of the same species as seen on slide No. 2.

In this vial, No. 4, is carious dentine mucus and saliva, which has been kept at the temperature of the mouth for forty-eight hours. In this preparation you see spirochate plicatiles, vibrio regula and what we take to be bacteria termo. Allow this preparation to remain a few days longer, and it will become so putrid and offensive as to scent this whole hall, so that no organism but bacteria termo will live in it. You meet with patients now and then with the accumulation of weeks in and around their teeth, who never use a brush, whose breath is equally offensive; for where particles of decomposing food remain undisturbed, through fermentation, the same thing goes on. There are one or two other preparations of carious tooth structure that we would like you to examine, but fear time will not permit. Enough has been said and seen to create inquiry if not conviction as to organic decay. The time is fast approaching when thinking minds will not be satisfied with the *old egg shell theory* that teeth are nothing but lumps of lime, and that the acetic acid of the mouth decomposes them. This theory, ridiculous and untenable as it may seem, has misled and placed our profession in a wrong position for over an age, and by false practice caused the loss of many teeth. But when we see in letters and journals such passages as the following from such men as Dr. Spalding of St. Louis, and Stockwell, of Springfield, Mass., there is reason to look forward to better teaching and more intelligent practice. In the March number of the New England Journal, Dr. Spalding says:

"My first experiments were made upon the saliva of a young girl (aged 12), whose teeth were decaying rapidly, so much so that fillings previously inserted, that is, before the case came into my hands, whether of gold or other materials, had lasted but a short time, and in whose teeth new cavities were constantly forming, and this at so rapid a rate that cavities of considerable size would form in the space of a few months, notwithstanding pretty thorough cleanliness and good general care. I looked to find an acid reaction of the saliva in this case, and had been reflecting on a course of medical treatment, having in view this supposed condition of the saliva. What, then, was my surprise on finding, after repeated tests, that the saliva of this young person exhibited in every test either a neutral or a slightly alkaline chemical reaction. In no one of a large number of tests was there any, even the smallest, acid reaction shown. I immediately sought other cases where a similar destructive process was going on, but the result in each was precisely the same as the case just narrated."

Dr. C. T. Stockwell writes: "The more I look into this thing the more convinced I am that the present and former teachings on the subject of Etiology of dental decay are erroneous and superficial. That acids are *not* the exciting cause. In fact, that acids have very little to do with it. The ever present germ and bacterial life in all stages of development, together with a *weakened condition* of the nervous tissues, are the two necessary conditions of tooth decay. The laws and processes of *putrefaction* come in here as the '*sub*-structure' upon which we have to erect *our* '*super* structure.' Is this not so? This is a subject that will no longer down at a cold sneer or shrug of the shoulder. The profession have got to meet this question and prove it erroneous or accept it with all an acceptance implies."

In conclusion, then, in order to be correctly understood, *we repeat that acids are not the cause of carious tooth structure. The real cause is bacteria inaugurated by air germs through first ferment. All pits, fissures, abraded, hidden, and all inaccessible places in and around the teeth, where particles of food or foreign matters of any kind are lodged and unmolested, organism follows organism, absorbing the bioplasm in the canaliculi, leaving the limey substance to disintegrate. The change of shade is caused by the pigment in the protoplasm* of bacteria, which is light, yellow, brown or dark, according to organic advancement. In disinfecting carious structure before filling, where there is danger of pulp exposure, we have been in the habit of using carbolic acid, chloride of zinc, or chloride of mercury, and have

had the satisfaction in after years of seeing the good results of this practice, and in quite a number of cases positive recalcification. Dr. R. Koch's experiments on bacilla, show that chlorine bromine and mercuric chloride give the best results. Solutions of mercuric chloride nitrate or sulphate, diluted to one in 100, destroy spores in ten minutes in prepared solutions. Does not this solve the mystery of the old mercurial fillings inserted over forty years ago and explain the cause of black recalcification of dentine often seen under those fillings? Amalgam at that time, as you know, was composed of coin silver and mercury, and the men using it were considered quacks and made little or no attempt of removing decay or surplus mercury. Our modern amalgams though *very pure*, and which take so *very little mercury*, don't give the same results.—*Independent Practitioner*.

35 West Thirty-fifth street.

EDITORIAL.

At the meeting of the Massachusetts Dental Society, the subjects discussed were old, yet always interesting and practical.

The Treatment of Devitalized Teeth, by Dr. S. F. Whitton, of South Boston, was presented in a clear, methodical manner, without notes, but showing a thorough preparation. His position that devitalized teeth, whether recent or of long standing, need only the thorough cleansing and filling of the pulp cavity *as nearly as possible* to the apex, was supported by forty-five recent test cases, with only one failure. His method of cleansing and filling, the instruments, and material used, and a statement of the difficulties often encountered, were fully presented, and showed that he is thoroughly at home in that department of surgery. We hope to publish a paper from Dr. Whitton on this subject, as it is one of great practical importance to every dentist.

Prof. D. D. Smith, of Philadelphia, read a carefully prepared paper on Materials for Filling. He advocated the use of the combination of amalgam and gold in soft and medium soft teeth. In hard teeth, gold alone is the best material. The reason why he prefers amalgam and gold is found in the results of his own experience in the use of gold alone, of amalgam alone, and of their combination, in the classes

of teeth named. The theory by which he explains the results, is that the galvanic action of the metals (Palmer) prevents the re-appearance of caries. This paper is to be published in full.

Prof. Smith also gave a detailed description of his method of placing porcelain crowns on natural roots, which he thinks superior to the Bonwill crowns. His method in its general features is an old one —an ordinary gold plate tooth, a platinum plate covering the end of the root, and a platinum wire extending as far into the root as admissible, and retained by gutta-percha. The features of special interest, and belonging to Dr. Smith, are the cutting away of the labial portion of the end of the root so as to bend the plate under the margin of the gum, thus preventing rotation on the pivot, and a better union of the crown with the gum; also, the use of sufficient heat, in packing the gutta-percha and pressing the crown to place, to insure the oozing out of all surplus material, and admitting the plate perfectly to place. Every part of the operation requires perfect work, and, when perfectly done, he thinks is superior to any other method of pivoting.

The *Independent Practitioner* was always a very good monthly, and it had more special articles on dental subjects than any other miscellaneous journal, but it seems to us in an enviable position now, having secured Dr. W. C. Barrett, of Buffalo, as dental editor. We need say but little about Dr. Barrett; only men not yet known, need puffing. From all we know about him, we expect the Independent Practitioner, under his management, to become a most popular and thoroughly scientific monthly.

The Dental Department of the University of California had their commencement exercises November 8, 1882. The following were the graduates: Thomas Watson Hall, Charles Wesley Hibbard, Thomas Morffew, John Henry Plomteaux, Charles Wess Richards, William Harry Stanley, Gustave William Sichel, M. D., August Van Crombrugghe.

S. W. Dennis, M. D., D. D. S., is the Dean of the Dental Faculty.

The third annual banquet of the Chicago Dental Society was given at the Palmer House, December 13. We wished we could accept the invitation to be present, but distance was an obstacle.

We call the attention of the profession to several new advertisements in this number, and especially to that of Drs. Mack and King, Mechanical Dentists. The tendency of the present day is, fortunately for suffering humanity, away from such *base* materials as rubber and celluloid. There are, however, many dentists who, having come into the profession within the last ten or fifteen years, are unskilled, or have not the necessary apparatus or equipments for the better class of work that is being demanded, or at least that *special cases* demand, that may find it convenient to avail themselves of the skill and experience of those who make the mechanical department in all its branches a specialty. We have reason to believe that these gentlemen are reliable and in every way competent and trustworthy, and cheerfully recommend them to favorable notice. By corresponding with them, special instructions may be obtained.

From an article of Dr. Willoughby Miller, of Berlin, Germany, that appeared in the Deutschen Medicinischen Wochenschrift, No. 39, 1881, but which has not received due attention in this country, we give some extracts:

"I maintain that there exist electrical currents in the mouth, but not between the filling and the tooth-substance; they are only produced by the heterogeneity of the metallic fillings."

"The conductive power of dry dentine for the electric current was tested with pieces of .03 mm. (.0012 inches) in thickness, and, in spite of the fact that the well-known galvanometer of Prof. Du Bois Reymond was used, not the slightest passage of electricity could be noticed."

"When the dentine was moist, the moisture conducted the current, as was proved by testing in sections in the direction of the tubuli, and across them. In the first case the conductive power was five times greater than in the second. In the second case the current had to flow for the greater part through the small ramifications of the tubuli, while in the first case, it could travel through the tubuli without much resistance from the dentine."

The First Dental Society, of New York, has suffered a great loss in the death of Dr. William H. Allen. A committee has drawn up resolutions and a memorial appropriate to the loss. We are forced, from want of space, to put it over till next month.

OPERATING TABLE AND LABORATORY.

ABRASION.

In considering the abrasion of teeth, we recognize but two causes: the mechanical and the chemical. As to a possible physiological cause relating to certain forms of (so termed) chemical abrasion, we have as yet very little knowledge. We know nothing of nature's processes in repelling causes of waste and disease encroaching upon teeth, excepting that irritation and consequent inflammation cause mal-formed lime deposits under certain circumstances that may be measurably protective, producing a tissue more dense than the original product.

I wish to call attention to the claim made by some of our earnest thinkers, that were it not for the constant supply, even to the periphery of the enamel, of such material as will measurably repair the waste produced by the *ordinary* use of the teeth, these organs would in a very brief time be wasted away, this assertion being based upon the belief that the protoplasmic dentinal fibers are in a certain sense transporters of the needed material to the dentinal *basis*-substance—which is quite likely true in a *modified* form, though I fail to see *proof of any such theory* relating to the subject in hand; though we have ample proof of the various forms of secondary dentine *within* the walls of *formed dentine*. The idea that is carried out by this claim is that, by this low circulation, the *rapid* waste of the crown portion of all teeth was prevented. Why are not "dead" teeth dissolved in a few years? If it is owing to the supply *nearly* equalling the waste that prevents rapid destruction of—say the incisors, why is it that the substance possessing the lowest degree of circulation, the enamel, should resist the causes of waste more than the dentine? All dentists are familiar with the fact that mechanically abraded incisor teeth are concave on the worn surfaces, not convex. The dentine may be very brown and dense, but it has wasted *more rapidly* than the enamel. Now the query arises, is it more than mere mechanical resistance that prevents a more rapid waste? The slow waste of enamel resulting in exposure of dentine, the terminal portions of the fibrillæ therein first wasting away, the canaliculi imbibe such substances from without as stain and block up these tubuli. Whether the idea carried out by the query be true or not, it is quite certain that from observations of

abraded teeth and a knowledge of their minute anatomy, the theory of a preventive physiological process is quite untenable.

R.

This article on Abrasion is a kind of query, and as it contains ideas which can be grasped and examined, we thought it worthy of careful consideration. The querist considers lime deposits, which are more dense than the original tissue, "measurably protective." Against what? Against acids, inflammation, or an outer enemy.

The idea that supply must be given to the periphery of the enamel, to prevent its being wasted away in short time, is not based on "the belief," which is only an explanation of the idea, but on the fact that acetic acid (vinegar), malic acid (apples), citric acid (lemon drops), tartaric acid (grapes), butyric acid (sauer kraut), lactic acid (milk), etc., are continually eaten, that they inevitably will dissolve some lime-salts and that, if it were not for supply, the enamel would soon be dissolved. Let any one make the experiment: Rinse the mouth perfectly clean, take acetic acid (vinegar) free from lime-salts, about twenty drops to a spoonful of water, roll it once with your tongue over your teeth, spit it in a test tube and test with oxalate of ammonia, and you will find the presence of lime. Some time ago the writer made experiments with teeth and acetic acid, and found that one week's immersion in vinegar of average strength was sufficient to dissolve the enamel entirely. Similarly act other acids. If we suppose in the average a daily contact of teeth with an acid of only two minutes,—practically it may vary perhaps from 0 to 15 minutes,—in about fourteen years the action of acid alone would have destroyed the entire enamel, but nothing of that kind is observed; hence, the unavoidable conclusion of a supply. How the supply may be brought about is open to conjectures, etc.; but we cannot fairly doubt the necessity of a supply.

The writer speaks of "mal-formed" lime deposits. The term is one we cannot quite comprehend. All things in nature are formed equally by the same law, and as long time as we have no standard how lime deposits ought to be, we cannot call any "mal-formed;" it may be abnormal, or in a wrong place, but it is well-formed in every case.

The querist is puzzled to give an explanation of the fact that dentine suffers more by abrasion than enamel, and that the teeth become concavely eroded on the chewing surface by "abrasion." Two fac-

tors come into play: First, dentine is no surface organ; secondly, dentine is softer. To understand the first factor more plainly, we have to compare the enamel with the other surface organs and their deportment in cases of injury. Wherever the surface of an organ comes in contact with air or the outer world, provisions, which we do not sufficiently understand in detail, are made against those outside influences. The skin continually throws off epidermis scales; the mouth, bronchi, etc.; epithelial debris, etc. Any injury to surface organs is quickly repaired, but if we prevent the action or formation of surface organs—epidermis or epithelium—the sloughing process goes on in the parts beneath those organs, and they, not being adapted to the direct external influences, only after long time and with difficulty recover, and then only after forming protecting layers. The same is the case with dentine. While the enamel fights successfully against external influences, as long time as they do not destroy its protecting structure, the dentine behaves like a connective tissue, or bone-substance beneath the periost, it succumbs easier to outside influences. This very fact is strongly in favor of a supply by the enamel and does not warrant in any way the sudden, hardly logical, jumping to the conclusion at the close of the little article. Such emphatic negations may be logically permitted to pulpit talkers whose whole strength lies in boldness of assertion, but not to the querist, who shows himself an astute and reliable observer.

M.

We wish you all a Happy New Year. Well, how about the new year? and how about the *old?*

Suppose we turn down the light and meditate for awhile. Let us look over our office and all its equipments. Are they all that they should be? And, above all, are they clean, or as they were left from the last patient? Are *we* what we ought to be, or have we misimproved our opportunities? Ah, how that case of a month ago torments us. Why does it persist in being present to our mind? Why had we not the ability to treat it successfully as well as the Dr. across the way, for whom we were left, resulting not only in the loss of a first-class patient, but, infinitely worse, the loss of reputation, which it is always so difficult to regain. Why do so many failures come trooping up before us? Ghosts are not very pleasant companions, are they? Well, the old year is gone, and are we not to decide what shall be the *new?* Will we have the same old experience, or will we be men, and fill

men's places in the world? In other words, *study* and *labor* till we are in the front ranks of the profession, and the public feel that we cannot be spared from their midst. Young man, are you ready for the advance? If not, remember that in the years to come your only harvest will be disgrace, when it might have been the victor's crown!

According to the Vienna Agricultural Gazette, it has recently been discovered that meerschaum pipes of excellent quality, susceptible of the highest polish, and even more readily colorable than the genuine *spiuma di mare*, may be made of potatoes. The familiar tuber, it seems, is well qualified to compete with the substance known to commerce as "meerschaum clay." Its latent virtues in this direction are developed by the following treatment: Having been carefully peeled and suffered extraction of its "eyes," the potato is boiled intermittently for thirty-six hours in a mixture of sulphuric acid and water, after which it must be squeezed in a press until every drop of natural or acquired moisture is extracted from it. The residuum of this simple process is a hard block of a delicate creamy white hue, every whit as suitable to the manufacture of ornamental and artistically executed pipe head as the finest clay. The potato, moreover, dealt with in the manner above described, promises to prove a formidable rival to the elephant's tusk. It may be converted into billiard balls as hard, smooth and enduring as ivory, and can be depended upon for an inexhaustible supply of carved umbrella handles, chess men and fans. As potatoes are plentiful all over the world, and likely to remain so, while elephants are, comparatively speaking, rarities, mankind at large may fairly be congratulated upon the discovery of a substitute for ivory, which can be produced in unlimited quantity, and at an almost nominal cost, taking into consideration the difference in price between a pound of the best kidney potatoes and a pound of prime elephant's tusk.—*London Telegraph.*

Have we here a new material for "base-plates" in artificial dentures?

It may not be generally known, but it is a fact worth remembering, that a small quantity of the unbleached sulphate of quinine, mixed with an ordinary tooth powder, forms an excellent quinine dentifrice, which not only preserves the teeth sound, and the gums healthy, but is found wonderfully efficacious for preventing toothache and neuralgia.—*Student's Journal, copied in Medical Record, Nov. 25, 1882.*

News comes from London that a cheap process of making aluminum has been discovered there, and the statement causes no little excitement among the metal workers of Birmingham and Sheffield. Aluminum has not been largely used yet, because it is too costly. However, metal workers and dealers have long been expecting the discovery of a cheap method of production which will make it available. Aluminum was sold not long ago for eight dollars an ounce, but can be bought for one dollar now, while a Philadelphia firm is said to offer it in large quantities for forty cents an ounce. It is a bluish white metal as strong as iron and only a third as heavy, and does not rust or tarnish. If the cost of making it can be brought down to a practical figure, it will be widely used in structures where lightness and durability are wanted. Prof. Newberry of Columbia College says: The process of production and the cost of bringing the ore from which it is made from Greenland have hitherto made it expensive. It ought really to become cheaper than iron, for it exists in an impure state in all our clays, and consequently the ore is more abundant than iron ore. Mixed with copper and other metals, it yields splendid bronzes which, like the aluminum, do not tarnish. If it can be cheapened, aluminum bronze will certainly supersede brass.—*Republican.*

More tools are ruined by overheating, coldhammering and overtempering, says the Scientific American, than can be redeemed by all the new recipes that have been invented. The only way that is really good is first to find a brand of steel that is good and suitable for the tools to be made, and stick to it. Next find by a few trials the lowest heat that will harden it in pure water at 70°, or ordinary shop temperature. If steel is hardened at the lowest heat, the temper will require drawing very little, that is, to a pale straw, full straw, or brownish yellow, but not deeper unless for wood-working tools with thin cutting edges, when a full brown may be desirable. File-makers use salt water for a hardening bath, because it makes the water more dense and the teeth harder, and of course more brittle. Sulphuric acid or mercury is sometimes used for hardening very small tools for cutting glass and etching stone. For springs the same care should be taken in regard to low even heating that is necessary with tools. Pure lard oil is as good and probably better than any of the many mixtures that have been tried for the hardening fluid; burning off may do for drawing the temper of small or thick springs, but is totally unfit for long or slender ones. Dip the hardened spring into a bath of oil heated nearly to its boiling temperature; this is the only way to get an even temper.

BABBITT METAL.

The alloy recommended by Dr. Haskell for dies in place of zinc is not a *true* Babbitt, but differs in that it contains but about half the amount of tin. There are many alloys used for machinery bearings, and sold as Babbitt metal, but it is almost impossible to find a lot made from the correct formula. The most common adulterant is lead, which, of course, lowers the price very materially, but renders the alloy absolutely unfit for dental purposes. We believe the alloy made from Dr. Haskell's formula ought, as he says, to drive zinc out of the laboratory. Take the formula in the August number of this Journal to any coppersmith and have the alloy made for about 35 cents per pound, or purchase none other than the S. S. W., at 50 cents, and give it a trial. Well, throw away your old zinc ! ! !

EUCALYPTUS.

We would be pleased to hear from members of the profession who are using this new antiseptic. Will it ever *supplant* carbolic acid, or will it simply be an *associate* of our *old friend?* Let us compare notes and learn all we can about it, and then give it its proper place in the medicine case, or, if need be, like many of its predecessors, throw it out altogether. From our short experience, we believe it has come to stay, and claim its place, *but not to supplant carbolic acid.*

In setting pivot crowns with gutta-percha, we have many times been obliged to heat them to so high a temperature as to cause considerable pain in carrying them fully to place. The thought suggests itself that pliers might be constructed with blunt beaks (perhaps of copper to hold the heat), and so formed as to firmly hold the crowns. With these heated to a suitable temperature, the work might be more perfectly done and the amount of pain reduced.

Edison has constructed for Prof. Fairfield of the New York college of veterinary surgeons an electric lamp which makes a 500-candle power in the area of a half-dime. The electrodes or carbon points are only one tenth of an inch in diameter, the object being to obtain the highest intensity within the smallest possible space. It requires a battery of about forty cells. The instrument was made to illuminate a microscopic objective constructed upon the newly discovered law of homologous sections.

In the Scheriff process for preserving milk, the milk while fresh is inclosed in glass vessels and heated by steam for from one to two hours to a temperature of 100° to 120°. All germs of fermentation are thus destroyed, the caseous albuminoids are peptonized so that the gastric juices can easily digest the finely divided flocks, and any germs of disease from which the cow may be suffering are killed.

Muhlenberg says that "if the vitality of a rabbit is lowered by the administration of phosphorus, micrococci, which under other circumstances do no harm, increase so rapidly as to be fatal."

SOCIETIES.

CONNECTICUT VALLEY DENTAL SOCIETY.

[Continuation of Report.]

EVENING SESSION—FIRST DAY, Oct. 26, 1882.

Opened at 7 P. M.

SECTION 2—Discussion of Dr. Stockwell's paper.

Dr. MILLER: I would like to ask if the germ theory will account for decay that has started and then stopped?

Dr. SEARLE: Take a tooth and fill it with tobacco, and then see.

Dr. MILLER: But we have decay of teeth where no tobacco is used, and that has stopped.

Dr. NILES would like to ask Dr. Stockwell about mouth-washes. It is stated, I think, that alkaline washes are in some cases worse than useless. Is it better to substitute acid washes?

Dr. STOCKWELL: In certain cases.

Dr. NILES: In what cases?

Dr. STOCKWELL: The reference to acid washes was made upon the basis of some of Tyndall's experiments. In case the saliva is acid, this condition is favorable to the development of a certain class of germs. If it is alkaline, or neutral, another class of germs will find favorable conditions for development. The use of soda water is indicated on a scientific basis only. We should first *know*, not guess, that there is an acid condition to be neutralized before an alkaline wash is prescribed. When an alkaline condition of the fluids of the mouth is habitually present, soda water, etc., can only be harmful.

Dr. SEARLE: I hope no one will get the impression that we are committed to the germ theory, or to any theory. We are trying to find the etiology of caries. If the birds of prey are not in one field, they may be in another, and our friends here may be able to help us find them.

Dr. NILES: I never supposed that soda water was intended as a mouth-wash. Carbonic acid is a solvent of tooth substance; carbonate of lime in water hardens it; boiling such water precipitates the lime, liberating the carbonic acid gas, and it makes the water soft. So far as the claims of the acid theorists, I do not understand that specific acids are present except in dyspeptic conditions. Where decay progresses slowest, the decay is darkest. Where neutralized conditions exist, there is no decay, or decay is stopped. The difference between acidity and fermentation consists in this, that where there is fermentation, there are micrococci present. These organisms produce acid, and thus produce softening of tooth substance. If there is as much lime-salts in the decayed substance as exists in the undecayed, we must account for the hardness of teeth on another basis.

Dr. ABBOTT: For many years I have looked upon the solution of teeth by acids as a theory of decay highly doubtful. I have long thought it needed support. The theory of decay by septic organisms, despite the work of English scientists, I think needs considerable support. Go back to those students who in earlier times investigated this disease. You will see that John Hunter thought it a condition of inflammation of dentine. I have many specimens to prove this to be true. I have held opinions upon this subject differing from any of which I have read. Septic theory! A structure that contains less than a third of organic matter that can be bored up by an organism—I don't understand such a performance. Several weeks since your secretary asked me what evidence I possessed in favor of an acid theory and the septic theory of decay. I wrote him that I did not believe in the acid theory nor in the septic theory; that I did believe in an inflammatory theory. In the dentine there is but 28 per cent. of organic matter, and in enamel but three or four per cent. Therefore, if the acid theory was true, the enamel would be wasted the most rapidly of any portion of the tooth; but this is not true. If Dr. Bödecker has found life in the enamel, is it not possible that it may be irritated? The terminal ends of these fibers of living matter are so covered over that they are not exposed until a portion of the surface

is dissolved. When this happens, the living matter becomes irritated; also, where the gum has receded from the tooth, we find extreme inflammation and tenderness—hypersensitiveness some call it, but they do not realize that it is irritation of living matter. Leber and Rottenstein find that leptothrix cannot enter the solid or well-formed tooth-structure. Dr. Nasmyth found fifty years ago the baccated appearance in decayed substance. We have bacteria in decay. The micrococcus is an oval or berry-shaped or an hour-glass shaped organism. (Illustrations upon the blackboard.) Prof. Mayr's statements I can agree to, because I have no reason to object to them and because I do not know anything about acids or alkalis in the mouth as productive of what is claimed for them. But this (makes diagram drawing) substance that becomes so soft, becomes as hard as flint if the local conditions and constitutional conditions are corrected. Why is this? What becomes of these gobblers?

Dr. STOCKWELL: These organisms have a relatively short life, and if the supply is cut off by a filling that hermetically seals the cavity they of course soon die, or are overcome by the interior vital forces.

Dr. ABBOTT: But how strange that these organisms should chew up teeth when they have so much in the mouth beside to live on! Dr. Searle's case reminds me of one I had a few years ago: A man called upon me who had not been in a dentist's chair before in twenty-two years. A molar appeared to have an old gold filling in it; it proved to be a plug of cotton, the size of a pea. I thought it very curious, and as there was a discussion upon the subject of cotton in teeth at that time going on between Drs. McQuillen and J. Foster Flagg, I sent the plug to Dr. Flagg to assist him in his theory, which was that it made a very good filling in some cases, while Dr. McQuillen maintained it would be destroyed. The cavity above this cotton was solid—no decay there at all. Now cotton is a vegetable substance, and dry, it will exclude germs; but moist cotton will not. My idea was that the food being kept out, the lime-salts could take their proper position and decay was stopped.

Dr. SHEPARD: I would like to ask if Dr. Abbott finds the globular and inter-globular spaces.

Dr. ABBOTT described these as the interzonal spaces, so-called by Dr. Atkinson. There are an unlimited variety of such spaces found in dentine.

Dr. SEARLE: I wish to ask if Dr. Abbott can account for decay of one tooth while its neighbor in contact is free from attack.

Dr. ABBOTT: All teeth are not alike in structure; a pit, a scratch may be sufficient to be a recess for decomposing food, and softening must result.

Dr. BARTHOLOMEW: What is it that causes irritation upon the surface of the neck of a tooth?

Dr. ABBOTT: There is a large amount of living matter at that point, and as the gum recedes it becomes exposed. The acid that forms in mouths where such receding occurs, is sufficiently concentrated to irritate, and I treat such cases with carbonate of soda, tannic acid and glycerine. Putrefaction of any organic substance will produce lactic acid, and this must have an influence on lime.

In response to an inquiry from a member regarding the application of his inflammation theory to decay of "dead" teeth and ivory teeth inserted in artificial dentures, Dr. Abbott finally admitted that possibly the germ theory would apply in such cases.

Dr. ATKINSON: Than to say what I know, it would be easier to say what I don't know about this interesting subject. One great fault is the false nomination at the bottom of this subject. There is no antagonism between acids and alkalis. The antagonism exists in our false conceptions of primal truths. Germs is another false nomination. We must understand the great beginning—the laws of tissue-building first, before we can properly conceive of a retrograde movement of any kind. We must understand the structural organization of the tooth if we would explain the movements going on within. Inter-globular spaces are remnants of the law of calcification of dentine—or the embryonal bodies thereof—being incomplete. Is it an *over* calcification, or are they caused by a *lack* of calcification? It is imperfectly finished work, but just how, is not settled. This condition differs materially from the spaces found near caries, these last being a return merely to the embryonic condition.

SECTION 3. Dr. NILES remarked, making his report, that he was much discouraged by the disappointments of the last meeting. He thought that the members had not supported him in furthering his work; that members of Sections ought to do all in their power to assist the committees. Sickness in his family had, with many other cares, prevented his personally doing much the past year. He would, however, take the liberty of introducing the subject of Phosphate Filling Material. He believed it possible to have a permanent phosphate filling material, and that it can be so prepared as to be permanent. Long struggling with non-cohesive gold had taught him much.

He had thought it the best and only proper way to use it for filling teeth, but he had lately given much more time to the study of phosphate filling. He believed that there are phosphate fillings now made that will be serviceable for six or eight years. We have failures with gold and failures with amalgam, and I believe that failures with a *dark-colored* cement filling will not be in greater proportion than to gold and amalgam, while the cement will answer a far better purpose, is easier of adaptation, and will give better satisfaction during its term of service.

PAPER—Subject: *Phosphate Filling Material.*

Discussion.

Dr. SHEPARD: In experimenting upon cements, I think the key to the whole matter is a knowledge of the chemical laws, while at the same time one must keep a careful record of the *make* of cement or gutta-percha he uses, so that after long periods reference to this record will show which make wears best. One patient said recently that an oxy-chloride zinc filling had been in the buccal cavity of a molar sixteen years. I fear this statement was a little exaggerated. The conditions of the particular mouth are to be considered, and the probable effects of these conditions upon the durability of the filling; also, the different methods of mixing the same kind of filling material. I think, with Dr. Niles, that it is possible to make durable fillings of oxy-phosphate, or even of oxy-chloride, if chemical laws are carefully understood. *Record* your cases; state whether rubber dam is used or not, the time kept dry, etc. Experiment in your laboratory with each filling material, and learn the best way to mix it.

Dr. NILES: Cements. where in liquid state, are hydraulic; therefore, slow setting, and the saliva which gets to the surface will often facilitate the setting of the cement. The heat of the tooth also facilitates the setting. Dr. Bödecker uses Poulson's cement. It is an English make, very expensive, but is in every way a first-class article.

Adjourned to Friday, A. M., 9 o'clock.

The eighteenth annual meeting of the Massachusetts Dental Society was held in Codman and Shurtleff Hall, Boston, Mass., December 14 and 15, 1882, the President, Dr. D. B. Ingalls, of Clinton, in the chair.

The records of the last meeting were read and approved.

Reports of the various officers and committees were acted upon.

Voted, That the next semi-annual meeting be held in Springfield, Mass.

Dr. C. A. Brackett, of Newport, R. I., read the annual address.

Dr. D. F. Whitten, of South Boston, read an essay on "Treatment of Devitalized Teeth."

Dr. D. D. Smith, of Philadelphia, read an essay, "Discrimination in the Use of Filling Materials."

ELECTION OF OFFICERS FOR 1883.

President, Dr. F. Searle, Springfield.
First Vice-President, Dr. A. B. Jewell, Newton.
Second Vice-President, Dr. D. M. Clapp, Boston.
Secretary, Dr. W. E. Page, Boston.
Treasurer, Dr. E. Page, Charlestown.
Librarian, Dr. R. R. Andrews, Cambridge.

Executive Committee.

Dr. D. F. Whitten, South Boston.
Dr. F. E. Banfield, Boston.
Dr. J. S. Hurlbut, Springfield.
Dr. J. F. Adams, Worcester.
Dr. Leon Rideout, Lynn.

Voted, That Dr. J. T. Codman read his essay, "Reminiscences of the Society," at next meeting.

Dr. W. E. PAGE, *Secretary*.

We are kindly furnished with the following

OBITUARY.

Dr. Amos Johnson, the oldest dental practitioner in the city of New York, died December 10, 1882, at his late residence, 239 West Thirty-Eighth street. The services, which took place on the 12th ult., were largely attended by professional friends. Interment was made at Woodlawn cemetery.

Dr. Johnson was a graduate of medicine, which he practiced successfully in connection with dentistry. During his busy professional career he found time to write, and he leaves a large amount of unpublished manuscript, which he intended to have published in book form, it being the culmination of his long life-experience, study and investigation.

Dr. Johnson was an example of the Christ-spirit; the latter part of his life was mostly spent in "going about doing good." He was a genial and true friend, and lived a life without spot or blemish. His meek and lovable disposition endeared him to all who knew him.

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